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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/666,671	09/17/2003	Hongqin Shi	P118-US	8251

26148 7590 12/27/2005

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EXAMINER	
VINH, LAN	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 12/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/666,671	SHI ET AL.	
	Examiner	Art Unit	
	Lan Vinh	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 June 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,5-21,24-64,66-73,79 and 80* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3, 5-21,26-64,66-73,79 and 80* is/are rejected.

7)☒ Claim(s) *24 and 25* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/5/2005 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 26-29, 48-52,66-71 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 26 recites the limitation "the removal of the sacrificial material" in claim 1. There is insufficient antecedent basis for this limitation in the claim.

Claims 48, 49 recite the limitations of "the structural material remain in the microstructure" and "the removal of the sacrificial material" in claim 30. There are insufficient antecedent basis for this limitation in the claim.

Claims 66-71 are indefinite because they depend on cancelled claim 65

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-3, 5-7, 10-15 are rejected under 35 U.S.C. 102(b) as being anticipated by Lebouitz et al (US 2002/0033229A1)

Lebouitz discloses a method for etching semiconductor sample. The method comprises the steps of:

loading a semiconductor sample/microstructure into an etch chamber of the etch system, wherein the sample comprises silicon /sacrificial material and one or more structural materials (col 3, paragraph 0033)

providing a spontaneous vapor phase of xenon difluoride to the etch system (col 3, paragraph 042)

providing an additional amount of vapor xenon dilfuoride/vapor etchant recipe to the etch system at a time that is determined based on a measurement of an amount of an etchant/chemical species (col 6, paragraph 0054, col 8, paragraph 0066)

The limitations of claims 2, 5-7 has been discussed above

Regarding claim 3, Lebouitz discloses producing an etch by-product (col 6, paragraph 0052)

Regarding claims 10, 11, Lebouitz discloses introducing nitrogen/diluent into the chamber (col 4, paragraph 0038)

Regarding claim 12, Lebouitz disclose the step of adding the xenon gas/etchant to the system when a changed of the measured amount of the etchant reaches a preset value (col 6, paragraph 0054)

Regarding claims 13-14, Lebouitz discloses the step of preparing the etchant in vapor expand chamber/exchange chamber and supplying the etchant through a loop that passes through the etch chamber (fig. 3)

Regarding claim 15, Lebouitz discloses performing etching in pulses (col 6, paragraph 0054

5. Claims 30-31, 37-40, 42-45 are rejected under 35 U.S.C. 102(b) as being anticipated by Lebouitz et al (US 2002/0033229A1)

Lebouitz discloses a method for etching semiconductor sample. The method comprises the steps of:

loading a semiconductor sample/microstructure into an etch chamber of the etch system, wherein the sample comprises silicon /sacrificial material and one or more structural materials (col 3, paragraph 0033)

providing a spontaneous vapor phase of xenon difluoride/noble gas halide to the etch system over time to etch the sample/microstructure (col 4, paragraph 0038), the amount of the etchant varies per time unit (col 6, paragraph 0054)

The limitations of claims 31, 40, 42-43 has been discussed above

Regarding claims 37-39, Lebouitz discloses chosing the system parameter of the etching system using the gas flow rate, etch time (col 4, paragraph 0038)

Regarding claims 44-45, Lebouitz discloses introducing nitrogen/diluent into the chamber (col 4, paragraph 0038)

6. Claims 53-56, 58-59, 61-62 are rejected under 35 U.S.C. 102(b) as being anticipated by Lebouitz et al (US 2002/0033229A1)

Lebouitz discloses a method for etching semiconductor sample. The method comprises the steps of:

providing a spontaneous vapor phase of xenon difluoride/noble gas halide to the etch system over time to etch the sample/microstructure (col 4, paragraph 0038), the amount of the etchant varies per time unit (col 6, paragraph 0054)

Regarding claim 54, Lebouitz discloses choosing the system parameter of the etching system using the gas flow rate/concentration, etch time (col 4, paragraph 0038)

The limitations of claims 55-56, 58-59 have been discussed above

Regarding claims 61-62, Lebouitz discloses introducing nitrogen/diluent into the chamber (col 4, paragraph 0038)

7. Claims 72-73, 79-80 are rejected under 35 U.S.C. 102(b) as being anticipated by Lebouitz et al (US 2002/0033229A1)

Lebouitz discloses a method for etching semiconductor sample. The method comprises the steps of: choosing/collecting a plurality of data of a parameter that characterizes an etching process using vapor etchant recipe comprises xenon

dilfluoride, storing the data and etching a sample using the recipe based on the collected data (col 4, paragraph 0038)

Regarding claim 73, Lebouitz discloses choosing the system parameter of the etching system using the gas flow rate/concentration, etch time (col 4, paragraph 0038)

Regarding claims 79-80, Lebouitz discloses introducing nitrogen/diluent into the chamber (col 4, paragraph 0038)

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 8, 41, 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lebouitz et al (US 2002/0033229A1) in view of Tai et al (US 6,436,229)

Lebouitz method has been described above. Unlike the instant claimed inventions as per claims 8, 41, 57, Lebouitz fails to disclose using BrF3 as a vapor etchant

Tai discloses a method for etching comprises the step of etching silicon using BrF3 (col 3, lines 10-15)

One skilled in the art at the time the invention was made would have found it obvious to substitute Lebouitz xenon difluoride vapor etchant with BrF3 as per Tai because Tai discloses that BrF3 has higher etching efficiency than that of xenon difluoride and BrF3 is also cost effective when compared with the use of xenon difluoride (col 3, lines 5-10)

10. Claims 9, 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lebouitz et al (US 2002/0033229A1) in view of Zhang et al (US 6,162,585)

Leboiutz method has been described above. Unlike the instant claimed inventions as per claims 9, 60, Leboiutz using a vapor etchant recipe comprises of xenon difluoride instead of HF

Zhang discloses a method for etching using vapor HF (col 5, lines 39-40)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Lebouitz by using vapor HF etching as per Zhang because Zhang discloses that the allowable duration of vapor HF etching allows deeper etch (col 5, lines 63-67)

11. Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lebouitz et al (US 2002/0033229A1) in view of Chinn et al (US 6,666,979)

Leboiutz method has been described above. Unlike the instant claimed invention as per claims 16-17, Leboiutz fails to disclose coating the microstructure with a SAM and the etchant has a pressure from 0-15 Torr

Chinn discloses a method for dry etch comprises the step of etching using the etchant has a pressure from 10-12 Torr and coating the microstructure with a SAM (col 11, lines 18-45)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Leboiutz method by coating the microstructure with a SAM to prevent stiction during handling and using an etchant has a pressure from 10-12 Torr to produce

only a few monolayers on the substrate as taught by Chinn (col 11, lines 16-19; lines 45-46)

12. Claims 18-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lebouitz et al (US 2002/0033229A1) in view of Han et al (US 6,740,247)

Leboiutz method has been described above. Unlike the instant claimed invention as per claims 18-21, Leboiutz fails to disclose that the diluent gas has a partial pressure from 20-700 Torr/ 50-100 Torr/500-700 Torr

Han discloses a method for HF vapor cleaning/etching comprises the step using a nitrogen /diluent gas has a partial pressure from 10-500 Torr (col 7, lines 55-57)

One skilled in the art at the time the invention was made would have found it obvious to modify Leboiutz method by using a nitrogen/diluent gas has a partial pressure of 10-500 Torr to enable stabilization of the operating chamber pressure as taught by Han (col 7, lines 55-58)

13. Claims 26-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lebouitz et al (US 2002/0033229A1) in view of Chen et al (US 6,159,851)

Lebouitz method has been described above. Unlike the instant claimed invention as per claims 28-29, Leboiutz fails to disclose that the structural material comprises a metal nitride

Chen discloses a method for forming a semiconductor device comprises the step of forming a TiN layer with a primary conductive layer (col 6, lines 4-6)

Thus, one skilled in the art at the time the invention was made would have found it obvious to modify Leboiutz by forming a metal nitride as per Chen because Chen discloses that the TiN provides conformal adherent coating on a lower metal (col 5, lines 14-16)

14. Claims 32-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lebouitz et al (US 2002/0033229A1) in view of Zhang et al (US 6,162,585)

Lebouitz method has been described above. Unlike the instant claimed inventions as per claims 32-36, Lebouitz fails to disclose providing a first amount of the etchant recipe at a first time, providing a second amount of the etchant recipe at a second time,wherein the first amount equals the second amount and providing a third amount of the etchant recipe at a third time, wherein the interval between the first time and the second time does not equal the interval between the second time and the third time

Zhang discloses a method for etching comprises the steps of providing a first amount of the etchant recipe at a first time; providing a second amount of the etchant recipe at a second time, wherein the first amount equals the second amount (col 5, lines 20-27) and providing a third amount of the etchant recipe at a third time, wherein the interval between the first time and the second time does not equal the interval between the second time and the third time (Table 2)

One skilled in the art at the time the invention was made would have found it obvious to modify Lebouitz method by varying the amount of the etchant in Lebouitz to obtain

the specific amounts as per Zhang in order to achieved desired etch depth as taught by Zhang (col 5, lines 49-52)

15. Claims 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lebouitz et al (US 2002/0033229A1) in view of Han et al (US 6,740,247)

Lebouitz method has been described above. Unlike the instant claimed invention as per claims 46-47, Zhang fails to disclose that the diluent gas has a partial pressure from 20-700 Torr

Han discloses a method for HF vapor cleaning/etching comprises the step using a nitrogen /diluent gas has a partial pressure from 10-500 Torr (col 7, lines 55-57)

One skilled in the art at the time the invention was made would have found it obvious to modify Lebouitz method by using a nitrogen/diluent gas has a partial pressure of 10-500 Torr to enable stabilization of the operating chamber pressure as taught by Han (col 7, lines 55-58)

16. Claims 48-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lebouitz et al (US 2002/0033229A1) in view of Chen et al (US 6,159,851)

Lebouitz method has been described above. Unlike the instant claimed invention as per claims 49-52, Lebouitz fails to disclose that the structural material comprises a elemental metal and a metal nitride

Chen discloses a method for forming a semiconductor device comprises the step of forming a TiN layer with a primary conductive layer (col 6, lines 4-6)

Thus, one skilled in the art at the time the invention was made would have found it obvious to modify Zhang method by forming a metal nitride as per Chen because Chen discloses that the TiN provides conformal adherent coating on a lower metal (col 5, lines 14-16)

17. Claims 63-64, 66-71 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lebouitz et al (US 2002/0033229A1) in view of Winningham et al (US 6,518,194)

Lebouitz discloses a method for etching semiconductor sample/microstructure. The method comprises the steps of: collecting a plurality of data of flow rate/concentration of the etchant/ parameter during a first etching for first series of sample/first microstructure using an spontaneous vapor phase etchant recipe of xenon difluoride, determining a variation profile of the parameter in the first etch process (col 6, paragraph 0054). Lebouitz also discloses producing an etch by-product (col 6, paragraph 0052)

Unlike the instant claimed invention as per claim 63, Lebouitz fails to specifically disclose the step of etching a second microstructure in a second etching process using the etchant recipe based on the collected data of the parameter in the fist etching process

Winningham discloses a method for transferring nanoscale pattern comprises the step of etching a second sample/microstructure in a second etching process using the etchant recipe based on the collected data of the parameter in the fist etching process (col 13, lines 55-58)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Lebouitz method by etching a second sample/microstructure in a second etching process using the etchant recipe based on the collected data of the parameter in the fist etching process in order to determine the time needed to etch through the sample as taught by Winningham (col 12, lines 52-55)

The limitations of claims 64, 66 have been discussed above

Regarding claims 68-69, Tai discloses using xenon difluoride (col 9, lines 32-33)

Regarding claims 70-71, Lebouitz discloses introducing nitrogen/diluent into the chamber (col 4, paragraph 0038)

18. Claim 67 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lebouitz et al (US 2002/0033229A1) in view of Winningham et al (US 6,518,194) and further in view of Tai et al (US 6,436,229)

Lebouitz as modified by Winningham has been described above. Unlike the instant claimed invention as per claim 67, Lebouitz and Winningham fail to disclose using BrF3 as a vapor etchant

Tai discloses a method for etching comprises the step of etching silicon using BrF3 (col 3, lines 10-15)

One skilled in the art at the time the invention was made would have found it obvious to substitute Lebouitz and Winningham xenon difluoride vapor etchant with BrF3 as per Tai because Tai discloses that BrF3 has higher etching efficiency than that of xenon

difluoride and BrF3 is also cost effective when compared with the use of xenon difluoride (col 3, lines 5-10)

Allowable Subject Matter

19. Claims 24-25 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

20. Applicant's arguments with respect to the use of Tai (US 6,436,229) and Zhang (US 6,162,585) as the primary references in previous rejection under U.S.C 102 have been considered but are moot in view of the new ground(s) of rejection based on Lebouitz et al (US 2002/0033229A1)

Conclusion

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 571 272 1471. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LV
December 20, 2005